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G5G
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(54) Electronic vibrational display, e.g. for braille

(57) An electronic vibrational display is provided comprising an input for information to be displayed and a plurality of touchable piezo-electric vibrational transducers selectively operable to display the information by vibration of successive combinations of said transducers preferably at a frequency of 250 Hz. The transducers are preferably sealed and both planar and circular and are each touchable through and peripherally sealed to holes in a casing in which they are mounted by a layer of resilient damping material secured to both the casing and the transducer so as to fulfill both mounting and sealing functions. The casing forms a mask revealing only a touchable portion of each transducer for the pad of a readers finger to contact the surface of the element. The transducers are preferably arranged in the casing in two aparallel lines each of three transducers for displaying braille encoded information.

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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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Fig.1.

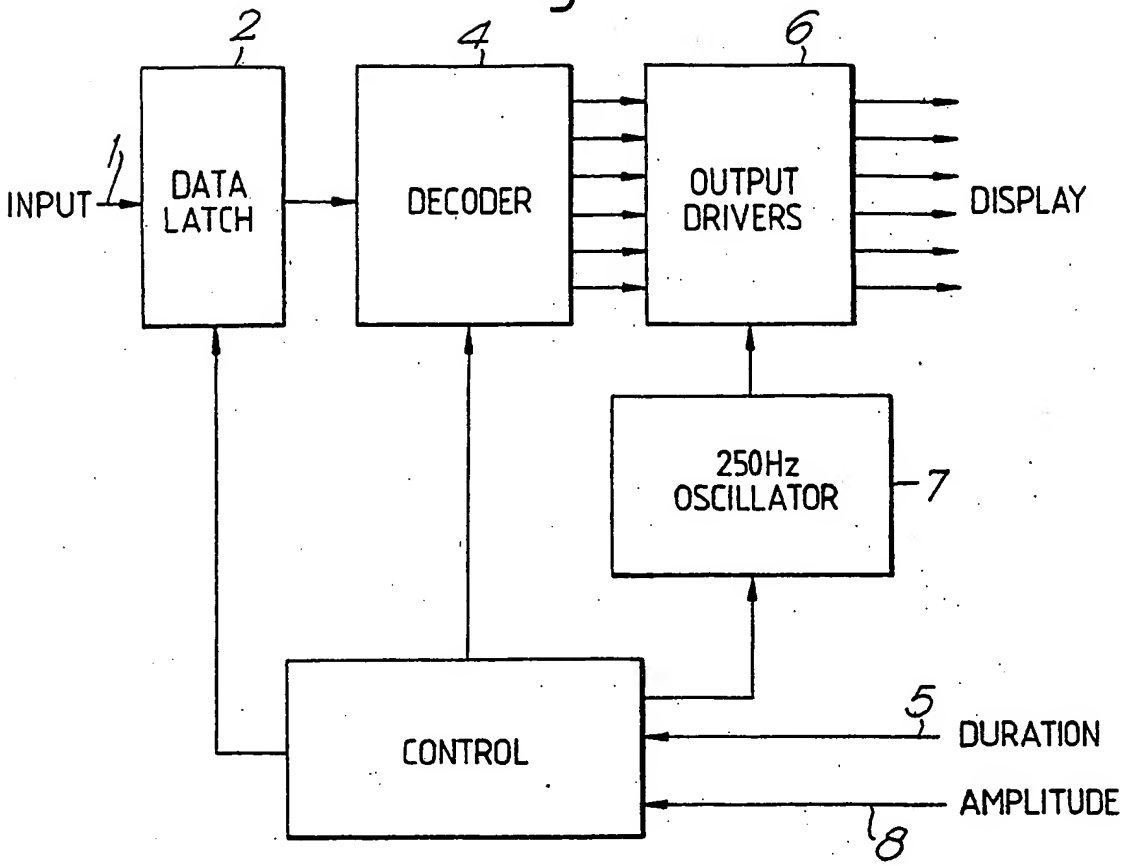


Fig.2.

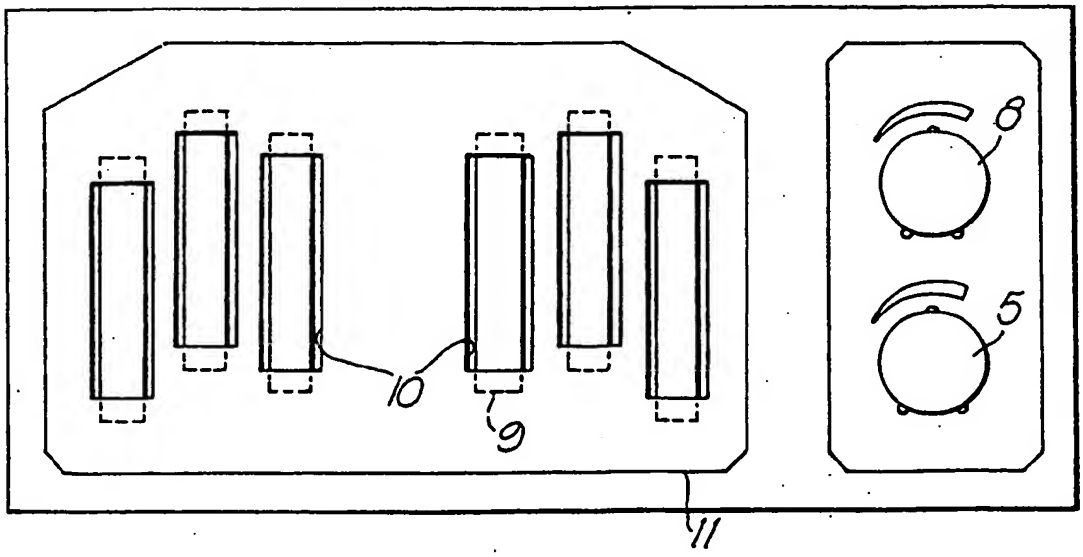


Fig.3.

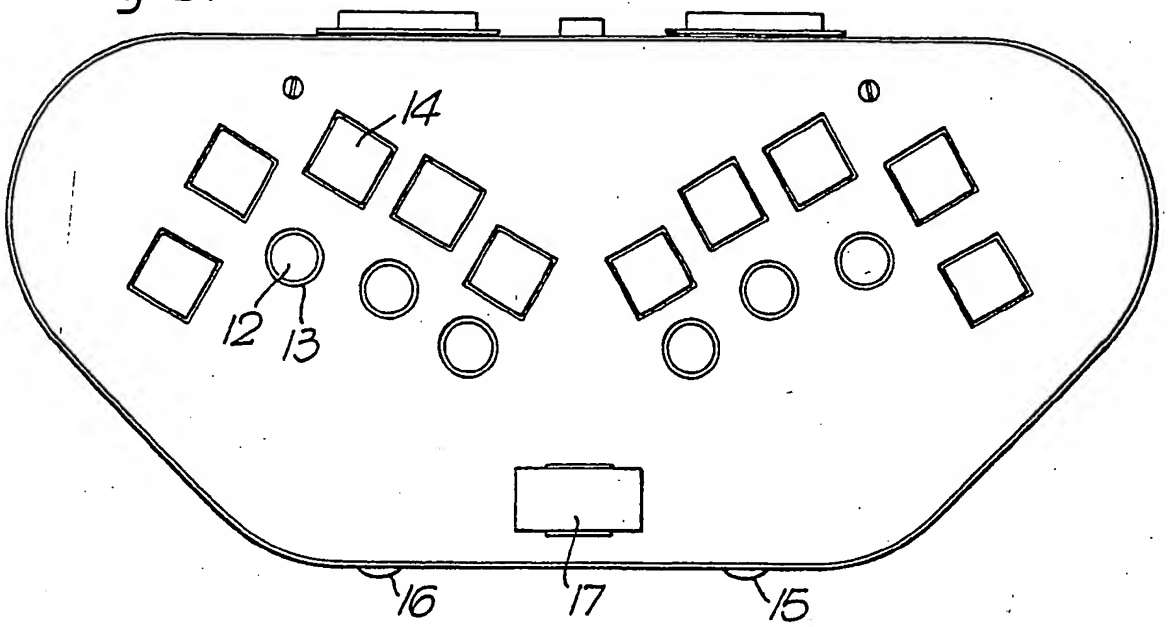
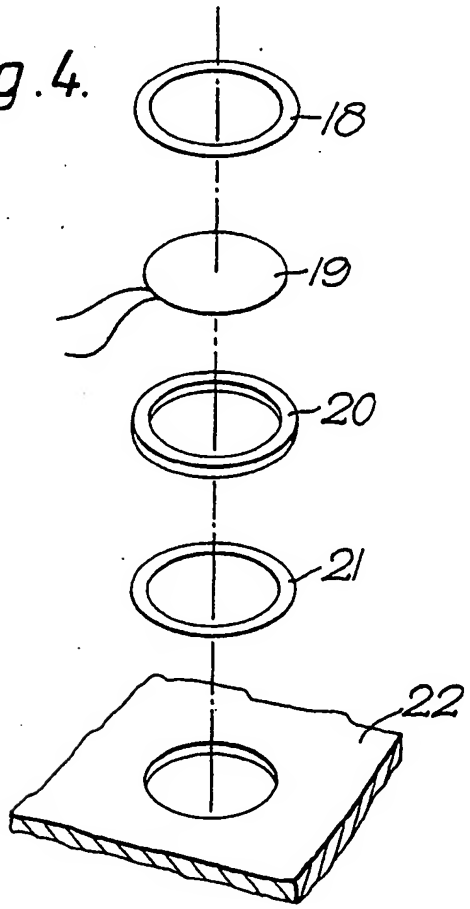


Fig.4.



SPECIFICATION

Electronic vibrational display

This invention relates to an electronic vibrational display. In particular the invention relates to an electronic vibrational display which may be used as a transitory Braille display.

The blind and particularly the deaf blind are very reliant on their tactile sense for non-verbal communication. Braille displays and particularly transitory ones, therefore fulfil an important role in providing an interface between such a user and a communication or information retrieval system. Hitherto the most common method of presenting a Braille display has been via raised dots. These are positioned in a conventional six point matrix and may be read using the pads of the reader's fingers. Recognition of Braille characters displayed in this way is dependent on nerve endings which respond to changes in pressure in the skin tissue and thus detect the dot edges. The use of Braille displays comprising raised dots, however, suffers from a number of disadvantages. Firstly, it is not ideal for very young or elderly users, the latter of whom comprise the majority of blind people. This is due partly to the difficulty of learning to sense the characters in a dot matrix and also to anatomical and neurological changes which occur in ageing and reduce the ability to detect raised dot patterns. Secondly, in the case of transitory Braille displays where the dots comprise pins which are raised and lowered through a reading surface by electromagnetic means, the pins are very susceptible to the ingress of dirt or sweat which can damage the display.

According to the present invention there is provided an electronic vibrational display comprising an input for information to be displayed and a plurality of touchable vibrational transducers selectively operable to display said information by vibration of successive combinations of said transducers. The use of vibrating elements to indicate the presence or absence of a Braille feature has the advantage that the frequency sensitive nerve endings of the finger pads (the Meissner corpuscles) possess a much lower threshold to stimulation than the edge detecting nerve endings (the Pacinian corpuscles) when reading the dots of a conventional Braille display.

The transducers may take any suitable form but are preferably individually sealed to exclude dirt from entering the transducer. Preferably the transducers are piezo-electric transducers. The use of piezo-electric elements to provide the vibrations is particularly advantageous since they are lighter, smaller and cheaper and have a lower power requirement than the electro-magnetic devices used in conventional raised pin Braille displays. Piezo-electric transducers also have the important advantage that they do not posess any relatively translationally moving parts and can each form a substantially sealed unit which dirt or sweat from a reader's fingers cannot enter. In contrast, conventional moving pin braille displays are very susceptible to this problem.

The piezo electric transducers may be mounted in a casing so as to be touchable through and peripherally sealed to holes in the casing. This prevents the ingress of dirt and sweat from a reader's fingers which might otherwise damage circuitry within the casing and results in a considerably longer life for the display and a reduction in maintenance costs when compared to conventional raised dot displays which due to the comparatively large movement of the pins cannot easily be sealed against the ingress of dirt. The piezo-electric transducers are preferably substantially planar whether or not their edges are sealed to the casing since this further faciltates sealing and mounting the transducers as well as the sealing of their edges to the casing of the display.

The transducers may take the form of rectangular piezo-electric transducers. These may be mounted at one end or at two opposing ends the latter of which gives greater strength when a reader's finger is applied to the element and the former of which gives increased amplitude to the vibrations. In each case additional sealing means would be desirable to prevent the ingress of dirt and sweat. Preferably however, the piezo-electric transducers should be circular and both mounted and sealed peripherally by some suitable means which fulfills both mounting and sealing functions. The use of peripherally mounted circular transducers gives both increased amplitude of vibrations and security of mounting. The sealing of the periphery of the transducers to the casing is not essential if the ingress of dirt into the casing can be tolerated since the piezo-electric transducers, once sealed are not susceptible to the ingress of dirt.

Whichever form of piezo-electric transducers are used portions of said transducers are preferably shielded by a mask revealing only a touchable portion of each transducer for the pad of a reader's finger to contact the surface of the element. The casing itself may be used to form such a mask. The use of such a means of restricting access to the transducers reduces the ability of a user to damage them by application of undue pressure on the transducers.

To increase the ease of detection of the vibrations by the readers fingers the elements are preferably caused to vibrate at around 100-1000Hz preferably 200-300Hz and most preferably 250Hz.

The present invention is particularly suitable for use as a transitory Braille display, however, it may be used to output information in any other coded form for detection by either blind or deaf blind people or sighted people in conditions of limited visibility and or audibility.

In the case of use of the present invention as a transitory Braille display six transducers are used corresponding to the six dot matrix of Braille characters. These are preferably arranged in the casing in two substantially aparallel lines forming a substantially V-shaped arrangement to facilitate correlation of the information detected with the standard Braille format at the same time as allowing easy reading using the reader's two hands. However additional keys may also be provided to act as for example shift keys and the like. These are preferably positioned on either side of the main six keys so as to be operable by an operator's little fingers.

The display may be connected to any suitable input

source which may be for example the output from a word processor, a typewriter or a databank any of which may be linked by a modem and a telephone network to the Braille display. In this manner telecommunication with blind or deaf blind people can be facilitated. The device can also be used to enable communication between two deaf blind people each using one of the devices.

Preferred embodiments of the present invention will now be described with reference to the accompanying drawings in which:

Figure 1 illustrates in diagrammatic form the control system for a display according to an embodiment of the present invention.

Figure 2 shows a plan view of a first embodiment of a display according to the present invention.

Figure 3 shows a preferred embodiment of the present invention comprising both reading and typing controls.

Figure 4 shows an arrangement for mounting a piezo-electric element as used in the display as shown in Figure 3.

In Figure 1 the operation of a system for driving the display is shown in diagrammatic form. It shows the control of data flow through the system from the input to the vibrational display elements. The serial input data (1) containing for example a Braille message is held in a data latch (2) until the control circuit (3) releases it character by character to the decoder (4). The delay of the data release is determined by the user setting the duration control (5) which effectively determines the reading speed. The decoder (4) extracts the Braille character and outputs it in a six line parallel form to the output drivers (6). The six signal levels are used to enable the particular output drivers (6) to switch in an alternating voltage from the 250Hz oscillator (7) to the respective piezo-electric elements of the display. Using the amplitude control (8) the user is able to control the amplitude of the alternating voltage which directly controls the physical deflection of the display elements. He is thus enabled to adjust both the duration and amplitude of the Braille signals to suit his tactile sensitivity.

The driving system shown in Figure 1 can be enclosed in a suitable casing in which the vibrational display elements and duration and amplitude controls are also mounted. One example of such a casing is shown in Figure 2. In Figure 2 rectangular elongate piezo-electric elements (9) are shown mounted at each end across corresponding rectangular holes (10) in the chassis (11) of the casing. Amplitude (8) and duration (5) controls are also mounted in the casing. The piezo-electric elements (9) may be mounted at one end only though this renders them more susceptible to breakage when a readers finger is pressed against them and for this reason mounting at both ends is preferred.

In Figure 3 a preferred embodiment of a display according to the present invention is shown having circular piezo-electric elements (12) mounted behind holes (13) in the casing and adjacent switches (14) which can be used for typing in Braille. This enables the display to be used for not only receiving but also sending Braille or other messages. The amplitude (15) and duration (16) controls comprise thumb wheels mounted in the edge of the casing. A space bar switch (17) is also provided which may be positioned in the leading edge of the container or as shown on the upper front surface of the container.

In Figure 4 an arrangement for mounting the circular piezo-electric elements shown in Figure 3 is shown in greater detail. Adhesive tape (18) is used to secure the piezo-electric element (19) to a ring of resilient damping material (20) which is used to isolate the vibrations of the piezo-electric element from the casing so as to eliminate cross over effects between adjacent elements. The resilient damping material may be any suitable such material but preferably it comprises a material such as "Tico S" sheet produced by J Walker Ltd. This sheet together with the piezo-electric element is secured to the casing or other mounting place (22) of the display casing using double sided adhesive tape (21). In this manner the piezo-electric element (18) is resiliently mounted to the casing so as to confine the vibrations of the element. Though the use of single and double sided adhesive tape is shown other suitable adhesive means such as an appropriate glue may be used. When the sheet (22) on which the element is mounted comprises the outer casing of the display the ingress of dirt and/or sweat from the reader's fingers is prevented and the display may be easily cleaned. The adhesive tape and resilient damping material fulfill both damping, mounting and sealing functions simultaneously in this case. However, the sheet (22) on which the element is mounted may comprise an internal mounting sheet which is suspended within a casing so as to position the elements beneath holes in the casing so as to allow access to the elements. In this instance the element may or may not be sealed to the casing as desired.

The piezo-electric element (18) may comprise any suitable piezo-electric element capable of vibrating at a frequency to which the human finger is sensitive. Preferably the elements are substantially planar and circular as described above. A particularly preferred form of the element is a piezo-ceramic transducer membrane as produced by Stettner & Co. In such a case the diameter of the piezo-electric part of the element is preferably 13mm the overall diameter of the element being preferably 23mm. The hole in the casing (20) allowing access of a reader's finger may be dimensioned suitably so as to allow just the pad of a reader's finger to touch the element and so as to minimise the pressure that a reader may exert upon the element so as to prevent damage to it. In such a case the aperture is preferably from 10 to 20mm in diameter and more preferably 14mm in diameter. However other suitable arrangements and sizes of piezo-electric elements may be used as appropriate.

CLAIMS

1. An electronic vibrational display comprising an input for information to be displayed and a plurality of touchable vibrational transducers selectively operable to display said information by vibration of successive combinations of said transducers.

2. A display according to claim 1 wherein said transducers are individually sealed.

3. A display according to claim 1 or claim 2 wherein said transducers comprise piezo-electric transducers.

4. A display according to any one of the preceding claims wherein said transducers are mounted in a casing and are touchable through and peripherally sealed to holes in said casing.

5. A display according to claim 4 wherein said transducers are both mounted and sealed by means which fulfill both mounting and sealing functions.

6. A display according to claim 4 or claim 5 wherein said transducers are spaced from said casing by a layer of resilient damping material secured to both said casing and said transducer.

7. A display according to any one of the preceding claims wherein said transducers are substantially planar.

8. A display according to any one of the preceding claims wherein said transducers are rectangular.

9. A display according to claim 8 wherein said transducers are mounted at one of their ends.

10. A display according to claim 8 wherein said transducers are mounted at two of their opposing ends.

11. A display according to any one of claims 1 to 7 wherein said transducers are circular.

12. A display according to any one of the preceding claims wherein portions of said transducers are shielded by a mask revealing only a touchable portion of each transducer for the pad of a readers finger to contact the surface of the element.

13. A display according to claim 11 wherein the casing of said display forms said mask.

14. A display according to any one of the preceding claims wherein said transducers vibrate at a frequency of from 100 to 1000 Hz.

15. A display according to claim 14 wherein said transducers vibrate at a frequency of from 200 to 300 Hz.

16. A display according to claim 15 wherein said transducers vibrate at a frequency of 250 Hz.

17. A display according to any one of the preceding claims comprising at least six of said transducers for displaying braille encoded information.

18. A display according to claim 17 wherein said transducers are arranged in said casing in two substantially aparallel lines.

19. A display as claimed in any one of the preceding claims comprising: buffer means to receive and store signals from said input; decoding means to decode signals output from said buffer means and to produce driving signals to drive individually one or more of said vibrational transducers; and control means to control the outputting to said decoding means of signals stored in said buffer means.

20. An electronic vibrational display substantially as described herein and with reference to the accompanying drawings.

21. Apparatus including an electronic vibrational display as claimed in any one of the preceding claims, further comprising keys for the inputting of information.

22. Apparatus as claimed in claim 21, further comprising a store to store information input from said keys.

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